FOSSILS—THE HOW AND WHY OF COLLECTING AND STORING

By Ellis L. Yochelson[1]
U. S. Geological Survey, Washington, D. C.

Introduction

Fossils, like eggplant and okra, are a matter of taste in the American community of naturalists. They are loved by a few specialists, tolerated by a few more broad-minded individuals, actively disliked by some extremists, but essentially ignored by the bulk of the populace. Accordingly, it is appropriate to review the ways that fossils arrive at museums, and their resulting fate, if only to bring these remains of organisms into the lifestream of natural-history collections.

No one knows how many fossils are still to be recovered from sedimentary rocks; no one even knows the far smaller total of the millions of fossils already collected and scientifically stored. Accordingly, this lack of knowledge provides an ideal opportunity for the fabrication of fact. The combined U.S. Geological Survey-Smithsonian Institution collection housed in the Museum of Natural History of the Smithsonian at Washington certainly contains more fossils than any other collection in North America and probably in the world. It is probably safe to add that many universities store only a token number of fossils in collections, though there are some impressive lots on a few selected campuses. Most collections outside Washington, D. C., are in State geological survey collections or in a limited number of major but somewhat smaller museums. Some oil companies maintain large numbers of microfossils, but these are out of the public domain.

Using a dirty crystal ball, one arrives at the figure of less than 25 percent and greater than 10 percent for the part of the

[1] Publication authorized by the Director, U. S. Geological Survey.

Nation's fossil collection that is in Washington, D. C. Roughly 20 percent of the Museum of Natural History storage space in Washington is devoted to fossils of the U. S. Geological Survey-Smithsonian Institution collection. However, this particular fossil collection has a far greater significance than just as a large percentage of the total American scientific material, for the Washington-stored fossils contain more specimens that have a documentary function than any other collection. Washington-based persons may be provincial and still do a fair job of study, but sooner or later paleontologists from other areas should visit Washington to look at types and special collections.

It is obvious from the preceding statements that the remarks expressed in this note are necessarily my own. Without attempting to degrade the variety of opinion in other fields of natural history, each reader should be informed quite clearly that paleontologists are highly individualistic in all facets of their activity. The reader is hereby warned that future statements made are entirely unsupported opinion. They apply mainly to fossils stored in Washington, and to their custodians, but might be more generally applicable if the underlying biases happen to strike a local and familiar chord.

Why Collect?

There is little sense in beating the dead horses of inherent curiosity, pushing back frontiers of science, search for the unknown, and other cliches to answer the question of why a person collects natural-history objects. A paleontologist collects fossils because he is professionally interested in them; others collect fossils to derive information or enjoyment from their possession. The paleontologist occupies an intermediate position between the pure compiler of geologic data and the pure lover of objects.

The latter might be mentioned first, though he does not deserve such harsh condemnation as mere "object lover." Amateur collectors are rare in the United States; the semi-pro who supplements his income by sale of fossils is even rarer. They may gather important collections, and they should be encouraged, but their overall contribution is negligible, especially when compared with the contribution of the amateur in Europe. There are probably fewer qualified amateur collectors now than in past years; the era between the Civil War and World War I was their heyday.

Field geologists and stratigraphers form the large group that uses information derived from study of fossils. The former are concerned with rocks of varying ages in a limited area; the latter are concerned with rocks of a more restricted age over a broader area. Both are concerned with questions of time or depositional environment of the rocks, and they pick up fossils to obtain evidence bearing on these points. It is my guess that more than 50 percent of the fossils in Washington were collected primarily to answer the problem of age of rocks. The percentage may be only slightly less in other large collections.

Paleontologists suffer many disadvantages in their studies because their specimens are incomplete in a variety of ways when compared with the biota that may be obtained in the Holocene. However, they do have one remarkable advantage over the neontologists in that collecting fossils is a four-dimensional operation involving latitude, longitude, altitude, and, uniquely, time. Others may write learned tracts on evolutionary theory, but only the paleontologist can collect one form at the bottom of a sequence of rock and another, related but slightly different, at the top. This element of time is the key factor in paleontology and is a dimension lacking in neontology.

In a crude way, one can draw a parallel between the field geologist awaiting the word of the paleontologist as to the age significance of a petrified form, and a quarantine inspector awaiting the word of an entomologist as to the identity of an insect before deciding whether to permit entry of a boatload of bananas. Another sort of time factor also enters here, for most paleontologists are of the opinion that anyone else's collection of fossils not only can, but should, wait to be examined. Paleontologists in museums, surveys, and groves of academe, often in good conscience, may delay months and even years in producing an answer to an inquiry about the age of a rock; bananas cannot wait that long. In contrast, the paleontologist employed by the oil company currently drilling a well is under even more pressure than a banana inspector.

Paleontology is closely tied to geology. In the past, although vertebrate paleozoology *in toto* and paleobotany in part were ignored by the field geologists as sources of useful data, invertebrate paleozoology was bound nearly hand and foot to the effort of age determinations. For the past few decades, this tie has loosened as the principal masses of sedimentary rocks were given relative age dates of moderate precision. This has also come about because of a shift of interest toward other problems in geology and a shift toward more biological topics in paleontology.

Under no circumstances should these remarks be interpreted to mean that the job of even approximate dating by fossils has been completed, or that it has been even locally accomplished with maximum precision. More accurate relative dates remain a prime job for the paleontologist. This close association of fossils and stratigraphy has been overemphasized in the past and is underemphasized in the present. As in many other situations, the middle ground is probably the route to pursue. Even with the relaxation of the stratigraphic tie, the paleontologist still obtains a large fraction of his material from the nonpaleontologist. The relation of geologist to paleontologist is certainly closer and more mutually meaningful than that of, say, geneticist to entomologist. Such relations should be encouraged.

How To Collect

When one asks a paleontologist how he collects fossils, the answer is generally a curt reply such as "meticulously." There are a variety of techniques, governed mainly by the kind of fossils and the kind of sediment which encloses them. Some people swear by a 1-pound hammer with a chisel end and a 14-inch handle; others swear at it. So many common-sense features are involved in collecting that a brief general summary on the subject was reviewed as being "downright inane."

In spite of this opinion, I believe that much remains to be discussed and written on the subject of fossil collecting. Although professional collectors have been employed permanently, this luxury is largely a thing of the past in the United States. Today, people continue to provide inadequate locality information when they submit collections of fossils for examination and do such silly things as write labels in water-soluble ink. If anything, the ability to obtain useful fossils, ship them, and have the collection arrive in reasonable shape and containing the proper information has lessened as interest in fossils has declined among nonpaleontologists.

Collecting may be reduced to two fundamentals. First, find a specimen, and second, retain it at least for a significant time interval. Expressions commonly heard are that collections were made, but after several years of just having them take up space, the fossils were discarded. Alternatively, one hears of the proverbial mountain slope littered with fossils, but they were not collected because the age of the formation was known. These are the hallmarks that distinguish the mere seeker of geologic data from the true paleontologist.

The real trick in the field is finding the first fossil in a sedimentary rock. Once this has been collected at the outcrop, the others come far more readily. Even knowing that years ago fossils were collected in the general area is a help. If the rock is a shale that breaks down to a mud and washes away, this first key fossil may be left as a lag deposit. Crawling on hands and knees, with nose at ground level, is the time-honored way of locating it. If the rock is harder, the hammer comes into operation. It may be more poetic to "bring the hammer into play," but even when the day is cool and the rock fairly friable, pounding on an outcrop for extended time periods is hard work.

The point here is that both of these operations have built-in limitations on the number of specimens that may be collected in a short time. The available collecting time at the outcrop, and the weight one person can easily carry for a short distance, have been the factors governing the amount of material that leaves the outcrop. To collect more than three or four bags of fossils at any one outcrop is unusual. If bulk samples can be collected rapidly, they are commonly of the type that requires extensive preparation prior to detailed studies of fossil content.

Thus, this kind of upper limit also holds for those who study microfossils. The time involved in taking a channel sample or digging a trench to collect fresh material may become significant. In comparison, for example, with a marine zoologist accustomed to collecting on a shallow-water reef, the paleontologist is a modest collector.

Extrinsic factors important to fossil collecting are not well understood. It is a general rule that one side of a roadcut will yield more specimens than another. Whether this is a regional feature or whether the phenomenon is related to local factors such as vegetation, runoff, or microclimate have never been investigated. Why some fossils in some rocks may be replaced by other minerals is a major mystery. The conditions that dissolve shells but leave their impressions are poorly understood in detail. The list could be continued.

Intrinsic factors also enter into collecting. There is no substitute for experience; some rocks just look right for a particular kind of fossil. In many respects, this is the same as a biologist knowing the life habitats of a desired living animal or plant specimen. This type of information can seldom be imparted except by word of mouth on the outcrop. At least one attempt was made to gather these esoteric tidbits as part of general work on techniques, but the results were far from satisfactory. The principal point distilled is that collecting is a full-time activity. It is possible and often necessary for the paleontologist to carry on more purely geologic work, such as mapping the area or measuring the thickness of a rock layer, but these have to be done before or after the collecting.

There is an interesting minor support of this hypothesis. In field-work in the western United States, a paleontologist visiting a field man may find more arrowheads in a few days than the field geologist finds in a season. The geologist strides across the landscape to get the big picture, but the paleontologist stays at one spot or shuffles along looking at the ground for his pet objects. Slow motion is also a fine way to avoid most rattlesnakes.

One final word should be said about general collecting. It would be nice if the various disciplines could assist one another. In olden days, travel was commonly by train from one outcrop to another. Because there was time between trains, some paleontologists used to obtain insects for their colleagues. It was a nice gesture and one that might be continued even in these days of more rapid transport, if there was a clear indication of what other people would like to have collected.

How To Store Fossils

In the how and why of collecting, the why is the easier to answer, or to at least open the floodgates of rhetoric. Once the fossils are safely inside a building, the how to store them is far easier than the why of retention. Compared with other natural-history objects, fossils are paradise for a curator.

Naturally, catastrophic events may cause serious losses. Type specimens lost during the great Chicago fire and the flood at Dayton, Ohio, still cause problems to a few specialists, but, hopefully, natural-history specimens today are as safe from such events as might be expected. Good collections are still in temporary repositories, and undoubtedly a quantity of important material will be discarded as some universities remove paleontology from the curriculum, but increasingly the odds against accidental loss are being lowered.

For convenience, collected natural-history subjects may be divided into three categories. First, living organisms, which are stored with great difficulty in zoos and arboreta. Second, recently dead objects, which must be pressed, vermin-protected, or bottled. Finally, dead things, which do not require watering and which do not deteriorate. About the only difficulty in prospect for a museum fossil is a coating of the ever pervading dust. The present-day air-conditioning expert would try to seduce us into believing that this problem has been solved; it is better to put one's faith and one's specimens in closed cases.

With fossils, one is not troubled by evaporation among alcoholics, which to the museum-oriented person does not mean unexplained staff absenteeism. One is not concerned with material drying to powder. Except for rare specimens replaced by pyrite, fossils do not pick up moisture from the air. Fossils are not edible, and though occasional labels and locality numbers may be lost to particularly desperate cockroaches or rats, such events have been fairly rare in the past and are essentially a thing of the past. Fossils do not change color after years of storage, nor do they smell.

About the only obvious and painful drawback to fossil storage is weight. The average collection of fossils, microfossils excepted, is heavier than the average collection of almost anything else in a museum. One drawer, 28 inches by 22 inches, full of particularly stony fossils, like colonial corals, requires complete attention during a moving operation. Drawers of fossils can be stored to a height of 9 feet, but an administrator, before making a decision for high-level storage, should be required to carry at least one drawer to the floor. There is a general rule of nature (Gumperson's Law) that the heaviest drawers are always at the top; for any case over 5 feet high this may become hazardous. It is also well known that museums that stack drawers rather than place them in cases, keep the needed specimens in the bottom drawer of a stack (Saunders' Corollary).

It is a wise idea to remember always that even though fossils are thoroughly dead, they still retain the ability to move. When specimens hop from one tray to another, the net result may be that two otherwise useful collections will have to be discarded. Trays with deep sides are not a luxury item. Because it is simply no longer feasible to put locality numbers on every specimen, stuffing the smaller specimens in glass bottles has been a technical breakthrough. Clear plastic boxes may well be worth however much more they cost; if they do come into general use in the near future, it will be about five decades since paleontologists stopped putting their prize fossils into cardboard pillboxes. Folded stand-up labels, in contrast to those that lie flat, are such a menace to retaining fossils where they belong and so antediluvian that examples should be put on special exhibit in the chamber of horrors.

There has been a tendency in unsympathetic administrative environments to equate storage of dead items with dead storage. If fossils cannot be seen easily, they will not be studied. Some of the greatest advances that have been made in paleontology stem from some things no more complex than making aisles wide enough so that drawers may be moved in and out of cases easily. Lighting adequate to permit specimen examination in a storage area has done more for overall clarification of species problems than the most sophisticated hardware of biometry.

Why Do We Bother To Keep Fossils?

There are so many reasons not to keep collections that one hesitates to open this question for discussion. Collections take up space, and space is money. They take up time, and time is money. About the only reason for keeping them is for the sake of honesty. If less painful words are needed, collections are kept for purposes of documentation and scientific verification, as well as to provide raw material for new studies. The Washington, D. C., collection includes more specimens that should be retained for purposes of biologic and geologic documentation than any other in America. There may be some merit in the view that once an optimal or critical size is reached, the importance of a collection increases more rapidly than its bulk.

A gifted mathematician may derive four from two plus two. Once this is published, another specialist with the proper computation can verify this discovery. In marked contrast, a relative date based on a fossil occurrence or a biological description of it is not nearly so tidy. No matter how good the printed description or how accurate the figures, sooner or later they are found wanting. If a paleontologist is smart, he will never completely trust the published work of another, but will look at the specimens in question. If he is particularly intelligent, he will not even trust his own published work and will continue to reexamine his fossils.

Systematic biology is an additive science and does not make great strides forward to major unifying natural laws. It does not lend itself to the sporadic quantumlike great leaps forward that have characterized the history of the physical sciences. Like all other kinds of systematics, paleontology moves forward at a crawl, building its monumental truths a dust particle at a time. We will probably never know with the precision of a mathematician the absolute stratigraphic range or total biologic diversity of a single extinct species, let alone the millions of such species that are in various stages of study, from those still awaiting collection on the outcrop to those in the latest published monograph.

However, every bit of new information throws a faint glimmer onto the overall biologic-stratigraphic system, and old material ought to be reexamined in this light, no matter how feeble the light may be. The great weight of fossil specimens described and those yet to be described is good ballast to keep the hot-air balloon of theory from rising too high. For the paleontologist, particularly, one battle cry is *alpha taxonomy forever!*[1] For this sort of old-fashioned work, one needs to look at specimens.

If one agrees that material should be kept, the logical position is to store it in the most useful system. This presumes a purpose in study, but the true paleontologist really has two purposes. One is biology and the other is stratigraphy. As a consequence, varying shades of schizophrenia infect the collections. In Washington, Geological Survey collections are stored in stratigraphic order and National Museum collections are stored partly in stratigraphic order, but mainly in biologic order. Types are stored in alphabetical order, for "convenience," an infelicitous expression if there ever was one. This dual system is found at most institutions that retain fossils. Of course, the outsider immediately objects that a unique specimen cannot be in two systems at the same time. This is absolutely true, but the dual system still works somehow and is used in most major collections throughout the world. Once the details of a particular local arrangement are understood in a museum, the paleontologist readily pursues his specimens up, down, and sideways through the collection.

The precise arrangement of the individual lots within a stratigraphic or biologic series is a subject for violent argument. One quick way to provoke argument is to state complete opposition to any arrangement by numerical sequence, for this is a simple method to follow; such simplicity is a trap. Collections should be in a subject matter arrangement just exactly the same way books are arranged in a library. Often the particular bit

[1] Editor's italics—author's exclamation point.

of information desired lies in the adjacent collection, just as the book you finally choose is adjacent to the one you originally thought you wanted.

A few words should be said about mechanics, because a poorly kept collection is a powerful administrative argument for discarding all fossils. In the part of the Washington megafossil collection that seems in best arrangement, the crucial element in the system is the one person whose job it is to keep track of things. About 40,000 collections are involved in this 70 year accumulation. Given a locality number, a particular lot may be located in 2 to 3 minutes. Because there is a logical arrangement, a blind search for fossil data on a restricted age and area basis can be run in less than half an hour. The only trouble with the system is inadequate manpower to bring all collections into proper curatorial shape within the system. We can keep current, more or less, but the backlog from past years is not reduced.

Automatic data processing will not help one iota in typing locality descriptions or preparing specimens. Some persons assume that an old system is necessarily outdated, whereas a more correct assumption is that the system has been time-tested and found to be successful. The classical methods have been "debugged," to use the current argot. Changing them may not be a wise investment of time or money.

The storage situation may be a bit more complicated with microfossils because one cannot simply look at the specimens with a hand lens. However, the same general principle holds, in that the collections should be arranged in a logical order. The nomenclatural situation within the field of foraminiferal studies is chaotic and is expected to get worse. The one reed left to cling to is the system of filing microfossil slides in alphabetical order by the original name. It works. Other kinds of microfossils may be filed by other arrangements.

This leads to the conclusion that the best system for any institution to follow is that which satisfies the workers most closely concerned. If this sounds trite, silly, and obvious, the other side of the coin is that an institution should be willing to stand the expense of major reshuffling as workers and ideas change. Libraries reshelve books when necessary and survive the process. Paleontologists generally are too xenophobic and ergophobic to put collections in the order that yields maximum information for their own purposes.

Granted that all published or cited material should be kept, something should be said about the residue. Many institutions, but particularly universities, tend to hang onto material too long. Much rock gathered during the preparation of a thesis should be discarded; the good material should be properly curated and saved. Junk brought in decades ago by field men and never cited can be discarded. Fossils do not age materially, but accompanying data may become obsolete. A collection "Carboniferous, Indian Territory" was important last century, but its time of significance is long past. To give another example, the push today is in paleoecology, but the collections made by prior generations are too biased to yield automatically the new data needed without additional field investigations. Field investigations in any area of natural history, including paleontology, always seem to yield collections!

Although it is easy to say discard unnecessary material, it is most difficult to do. One general rule to follow is that no one under 40 should be permitted to discard collections gathered by earlier workers. Often biologically poor material may be stratigraphically important and vice versa. Unless one has done fieldwork in rocks of a particular age and area, the best course is keep all the material already available for that age and area in storage. It is far better to err on the side of keeping too much than to discard an unmarked type specimen.

The time to discard is before collections are given numbers. Inadequate collections should be promptly abandoned and not left in odd corners, following the current method of continuing the sins of our predecessors. Proper curation is a thankless task which is generally shirked. Shame on all of us. If a fossil is worth keeping, it is worth keeping well.

Much as one hates to weaken a particular point, I must admit that although there are many good reasons for consolidating and discarding collections, economy is not one of them. One of the most expensive operations is to selectively prune collections. It is possible to work for a year and empty one or two storage cases.

Unless there is someone who has adequate time and cares enough to put the fossils in some order, all that results from collecting is a random arrangement of limited value. At the risk of annoying people further, a minor semantic needle should be emplaced. In my ancient Funk and Wagnalls, the word "collection" implies unorganized and promiscuous character similar to that of assemblage. This is hairsplitting, but it just could be that parts of our collection are properly so designated.

The Future

Scientists are supposed to make predictions, probably to prove that they are human and can be as mistaken as anyone else. Long-range predictions are better to make because the audience to whom the prediction was made is no longer around to ask questions. The alternative and next best method, which is followed here, is to make conflicting predictions, so that one prediction of the two may prove right.

Growth rates of collection bulk might be meaningful. By averaging a sample of palynologists, coral specialists, elephant hunters, and other assorted paleontologists, I have arrived at a figure of three museum cases 3 feet high per year. As these cases occupy 6.6 square feet and are usually stacked two high, space may be used at a rate of 10 square feet per year, plus all-important aisle space. Fifteen square feet of growth per man year is an authoritative wild guess. Thus, the new paleontologist starting out should be assured of 450 feet of space to fill with his collections, not counting what he will inherit in his specialty.

Unfortunately, collections simply do not grow this way. A better comparison is with growth studies of fish. If a large number of infant minnows are crowded into a small tank, they are stunted. When these stunted fish are transferred to a larger aquarium, however, they immediately grow to normal size. Available space determines the size of collections, not vice versa. Paleontologists assigned to new quarters with fresh storage space fill it rapidly and then are cramped until the next building provides a quantum jump. This principle has been checked at several localities and holds for at least North America and Europe.

It is also safe to predict that no extensive buildings for paleontologists in these regions are anywhere obvious on the horizon. Even more important, administrators have not been trained to think of large collections as scientific instruments. Major advances in other fields are accompanied by major investments in hardware. Probably the same principle applies in paleontology. Cyclotrons, sounding rockets, and radio telescopes really are not that different from new buildings filled with old organisms. Larger collections and advances in the field go hand in hand.

Another consideration beside storage space to fill is source of fossils. Most fossils gathered to date have been the product of long-time weathering processes. Once specimens are picked up from the outcrop surface, years of weathering are needed before others may be released. Some conservation-minded professors have preserved favorite outcrops only by extorting from a class all fossils collected and then sprinkling them back on the outcrop for next year's crop of budding experts to find. Most classic localities in this country have been picked or hammered clean of specimens.

Worse still, new exposures are not being developed for fossils. Lots of fossils once came from limestone quarries, obtained by the workers who were crushing stone by hand. Today, the rock is untouched by human hands from quarry face to cement bag. Railroad cuts used to be wonderful places to find fossils, but is there anyone still alive who can remember the last time a new railroad line was laid out. Highway cuts ought to be fine for collecting and were so for many years. No one is opposed to major erosion control, but the highway engineers think of erosion the same way as prohibitionists think of alcohol and consider even a tiny amount sinful. To see grass being sown on potentially highly fossiliferous roadcuts before even the concrete slab is poured is most discouraging. It is fairly safe to state that the bulk of the fossils that can be obtained easily from the weathered crust of the United States have been obtained and are stored away.

Having demonstrated why collections will not markedly increase in size, let me now take the counter argument. The wave of the future is already upon us, without any plans for coping with it. Paleontologists have known for hundreds of years that some fossils have been replaced by minerals that are insoluble in certain acids. Because of this, some outcrops have yielded choice fossils, or a specimen might be cleaned with a toothbrush soaked in acid, or one or two specimens might be freed from the rock matrix by placing the matrix in an acid-filled beaker.

Three decades ago, one of the senior National Museum paleontologists noted that chemical change of fossils persisted through the thickness of the rock. This fact was not new; more than half a century ago, fossil corals were dissolved from rocks and sold. However, he put an entire limestone block in acid, and then another, and another, and another. . . . The results have shaken the paleontologic world. The specimens obtained have been strikingly beautiful and highly significant both biologically and stratigraphically.

Perhaps even more significant for this discussion is the bulk of silicified fossils. By spending the same time at the outcrop, collecting limestone blocks rather than loose fossils, the number of specimens increases by many orders of magnitude. One hundred good specimens of a species from a single locality has been exceptional in the past. Now, a number of species are known from an entire case of choice material.

Silicified fossils are not sturdy. We have leaped from storing rocks to storing objects as delicate as butterflies. One does not pile up a heap of silicified fossils in the corner of a drawer. Good ones should be chemically hardened. They ought to be stored on cotton and even packaged individually. They have to be protected from the sudden jerk and slam of the conventional drawer with the sticking runners. When these fossils were first shipped between museums 20 years ago, the only known method was to imbed them in wax, and some have never been cleaned free of it. It has taken years just to stumble on the obvious idea of shipping them packed in sawdust. The field is wide open for new techniques.

All these new factors, brought into the picture by silicified fossils, mean a tremendous increase in space; I have no estimates other than "lots more." If field funds, preparation facilities, and technical assistance were optimum and permitted paleontologists to really move into the silicified fossil business in a businesslike way, the entire character of the collections could be changed in two decades.

Methods employed in obtaining silicified megafossils do not work for all paleontologists. Certainly, those who work on microsfossils and micro-microfossils should not be slighted, but one seldom has thought of them as requiring a great deal of space. However, new chemical and mechanical techniques have demonstrated that fossils are to be found in almost all sedimentary rocks. Today, it is a question whether the microscope slides or the black boxes and cameras take up more area. Suddenly the micropaleontologist wants a great deal more from life than space for a one burner stove to boil his pot of mud and a desk drawer to store slides. He may never individually require as much space as the bulldozer-wielding whale collector, but there are many more of the people working on the little bugs. Curiously enough, when prepared residues are retained along with their fossil content, more space is needed; no one throws away residues because there may be a need later to search in them for more microfossils.

This leads me to the final set of summary predictions. We will need substantially new buildings and much better handling and storing techniques for silicified fossils. Probably the best method will be to organize two separate collections, based entirely on the mechanical strength of the fossils. As a parallel development, microfossils are amenable to an organized, fully automated specimen storage and retrieval system. The paleontologist need only punch a few buttons on his room console to have the necessary slides moved into his microscope field.

For a century and a half, fossil storage has been essentially unchanged. Twenty years from now it will be all different. I have no idea where the money for a major national investment in paleontology will be obtained. The physicists became fat off of radar, and the chemists have done fairly well as a result of the atomic bomb. If, as a result of the moon race, the first extraterrestrial hand sample is fossiliferous,[1] perhaps paleontology will also reach the land of cornucopia. Until that golden day, collect new old fossils and keep them, no matter how tight the quarters, for only in this way will life continue to flow in the dry bones.

[1] Unfortunately, it wasn't and further the photographs of Mars do not look particularly promising as a nice place to visit, let alone live. However, there is always the hope of Venus or litter dropped by UFO's.